

# DENTAL SAFETY AND EQUIPMENT SAFETY

## SAFETY

This chapter is divided into two sections, dental safety and dental equipment. You must be knowledgeable of several safety concerns associated with the dental treatment facility (DTF). In the first section of this chapter, we will discuss dental safety. The various areas of safety include such things as hazardous materials, gases, chemicals, mercury, and other environmental hazards. In the second section, we will cover dental equipment and preventive maintenance.

## HAZARDOUS MATERIALS

The Federal Occupational Safety and Health Administration (OSHA) establishes regulations regarding the rights of employees to know the potential dangers associated with hazardous chemicals in the workplace. The goal is to reduce the risk of injury or illness caused by hazardous chemicals in the workplace.

Accomplishing this goal requires information and communication; therefore, OSHA issued *The Hazard Communication Standard*. This standard helps protect your right to work in a safe and healthful environment. It requires you to not only be informed about hazardous chemicals in your workplace, but also to be trained to work safely with these materials. Each DTF is guided by BUMED instructions to develop, implement, and maintain a written hazard communication program. This includes labeling, material safety data sheets (MSDS), and employee training. We will briefly cover labeling, MSDS, and some general handling precautions.

### Labeling and MSDS

Dental products considered hazardous should come from the manufacturer with a label identifying the chemicals and containing an appropriate hazard warning. You must pay attention to these warnings. The manufacturer must supply material safety data sheets (MSDS) for products that contain a hazardous chemical. An up-to-date file of these sheets must be maintained and available to all employees. You should take time to study these sheets because they contain

valuable data concerning precautions and the safe handling of each product.

### General Precautions for Handling Materials

If you know the general precautions for handling materials, you can easily prevent hazardous situations or accidents. Whenever you handle chemicals, follow the manufacturer's instructions. Know and use proper cleanup procedures. You must dispose of all hazardous chemicals according to the MSDS instructions and applicable local, state, and federal regulations. For your own protection, you should avoid skin contact with chemicals and minimize chemical vapor in the air whenever possible. Wear protective eyewear, gloves, and a mask to protect yourself. Never leave chemical bottles open. If you do, vapors can escape into the air and chemicals can be easily spilled when bottles are left open. Do not use a flame near flammable chemicals. Eating, smoking, or drinking is prohibited in areas where chemicals are used. Eating can cause chemicals to be ingested and smoking can cause chemicals to ignite or explode.

## GAS AND CHEMICAL HAZARDS

A variety of gases and chemicals are used or produced in dental facilities. It is important for you to be aware of the hazards and to take the necessary precautions.

### Gases

You must label, store, and use canisters of gases, such as oxygen, nitrogen, and propane, according to published standards. The use of nitrous oxide conscious sedation requires special training and the use of personal protective equipment by personnel during the administration of the gas.

### Toxic Vapors

Toxic vapors can be generated when mixing impression and denture materials. Using adhesive, solvents, acids and chemical sterilizers, mixing radiographic processing solutions, and mixing some disinfectant agents can emit toxic vapors. Besides the

danger from the vapors, direct contact with many materials, such as etchant acids, radiographic solutions, endodontic materials, or bleaching agents can cause chemical burns of the skin or eyes.

### **Chemical Storage**

Proper storage of chemicals is critical for safety. The type of container and cabinet, security, and proximity to other chemicals, materials, heat, or open flame are areas that need consideration and control.

### **How to Eliminate Hazards**

Proper ventilation can eliminate hazards associated with most gases and chemicals. Instructions must be written for the safe use, storage, clean up, and disposal of hazardous or contaminated items. Storage rooms must be properly furnished and maintained. Personnel protective equipment, such as a mask, shields, rubber gloves, rubber or plastic aprons, eyewear and eyewash stations must be available. Next we will discuss some of the specific chemicals used in dentistry and their precautions.

### **Organic Chemicals**

Examples of organic chemicals include alcohols, ketones, esters, solvents, and monomers, such as methyl methacrylate. When using these chemicals, you should avoid skin contact and excessive inhalation of vapors. Always work in a well-ventilated area with these types of chemicals. When not in use, keep containers tightly closed and stored on flat, sturdy surfaces. After each use, clean the outside surfaces of the containers to prevent residual material from contacting the next user.

### **Radiographic Chemicals**

These chemicals are used to process radiographs. When handling these chemicals, always work in well-ventilated areas, and wear protective eyewear, plastic apron, and rubber gloves to avoid skin contact. When mixing the solution, minimize your exposure to the dry powder. If spills of these chemicals occur, clean them up at once. If you should come in direct contact with these chemicals, wash the chemicals off with large amounts of water and a pH-balanced soap. Store radiographic solutions and chemicals in tightly covered containers in a cool, dark place.

### **Acid Etchants**

These solutions and gels are used for acid etch techniques. When using or handling these products, always wear protective eyewear and rubber gloves to avoid skin contact. Always handle acid-soaked items with forceps or gloves. If spills occur, use a commercial acid spill kit. In the event of eye or skin contact, rinse the area with large amounts of running water.

### **Flammable Liquids**

Many items used in dentistry are flammable. Solvents such as acetone and alcohol are examples. When using flammable liquids, always have adequate ventilation, never use where sparks or flames are present, and have a fire extinguisher available. You must store flammable liquids and bulk quantities in tightly covered containers in an approved flammable storage locker.

### **Gypsum Products**

These products, which include dental plaster and stone, are considered hazards because of their powder form and of the dust particles created when they are in use. When handling the powder form or trimming cast, use protective eyewear, a mask, and work in areas with an exhaust system. It is important to minimize your exposure to the powder during handling.

### **MERCURY CONTROL**

To minimize personnel exposure and environmental contamination of elemental mercury in DTF's, follow the handling procedures in BUMEDINST 6260.30.

Mercury, which vaporizes at room temperature, is a significant health hazard if a sufficient amount is ingested, absorbed through the skin, or inhaled. The potential for personnel exposure to elemental mercury vapor has been greatly reduced by the use of pre-encapsulated amalgam.

Because of the health hazard potential of mercury, control procedures for the handling and disposal of amalgam, or mercury-contaminated items are mandatory.

Dental amalgam is an inter-metallic compound comprised of various proportions of silver, copper, tin, and zinc alloy mixed with pure mercury. This mixture of metals forms a compound that is stable both

physically and chemically and will not break down into the original elements.

## **Personnel Hygiene**

Proper mercury handling and hygiene procedures are required for all dental personnel and will be emphasized during training and indoctrination periods. Before working with mercury-bearing materials (amalgam or scrap amalgam), personnel must remove all jewelry that could potentially become contaminated and permanently damaged. Eating, smoking, or drinking is not permitted while working with mercury-bearing materials. The use of patient examination gloves should be used to minimize skin contact. You should always wash your hands after working with mercury-bearing materials before leaving the DTR.

## **Work Surfaces**

Work surfaces are made of impervious (non-porous) material, usually made of stainless steel or plastic laminate.

## **Handling**

Personnel should use a no-touch technique for handling amalgam. After trituration (mixing) of the pre-encapsulated amalgam, personnel should use an amalgam well for loading the amalgam carrier. Personnel must also use water spray and the high-volume evacuator when cutting or grinding amalgam restoration. Collect all amalgam scraps before removing the rubber dam.

Amalgamators that completely enclose the capsule during amalgamation (mixing) should be used. The amalgamator enclosure should be inspected weekly for mercury globules and cleaned. The amalgamator should be disassembled only by a qualified dental repair specialist. Amalgamators, capsules, and other items that may be contaminated with mercury should be stored in an impervious catch tray. These items must be checked at least weekly for mercury droplets.

## **Amalgam Scraps (Waste)**

Amalgam scraps are left over pieces of amalgam generated from dental procedures. During the placement of amalgam in a tooth, the amalgam is a soft and malleable compound that quickly turns into a solid

hard mass. When amalgam turns solid, it is no longer useful for dental procedures and must be stored in a solids container.

Dental amalgam scrap is stored in a **dry state** in an approved solid container without any vapor suppressant solution and is not considered a hazardous waste. It is also necessary to clean the solids strainer (collector) of the dental evacuation system and recover any scrap amalgam that has been evacuated (suctioned) during dental procedures. Place any scrap amalgam from the solids strainer into a solids container. The following containers are approved to store scrapamalgam:

- Surgical needle jar with cover.
- Urine specimen cup with cover.

It is very important to keep the dental scrap amalgam cover in place to prevent spillage when not in use. When the container becomes full, follow your clinic procedures for turning in scrap amalgam for disposal.

## **Floors**

Vinyl sheeting is the preferred floor covering material for DTRs; carpet is not permitted. The use of pre-encapsulated amalgam products has not precluded dental waste or scrap from falling to the floor and being crushed into crevices; therefore, seamless floors are preferred. Floors should be kept clean and free of amalgam debris.

## **Mercury Decontamination and Spill Cleanup Procedures**

A mercury decontaminant should be readily available for immediate mixing and application to a contaminated surface. The decontaminant works by binding with the elemental mercury. If larger droplets of mercury are present, the decontaminant only reacts with the outer surface of the droplet forming a shell. This shell can easily be broken, releasing elemental mercury. Care must be taken during removal of large droplets.

When mercury contamination occurs, it must be cleaned up immediately with a mercury decontamination kit. Follow the manufacturer's instructions for use of these kits. Use the following guidelines for mercury cleanup and decontamination:

- Do not eat, drink, or smoke during cleanup procedures.

- Wear patient examination gloves during cleanup.
- Place collected mercury in a sealed, suitable liquid- and vapor-tight container, and remove to a designated area for disposal as mercury waste.
- Scrub contaminated surfaces with mercury decontaminant to convert any trapped mercury.
- Clean thoroughly any equipment or instrument, such as amalgamator, that becomes contaminated with mercury with a mercury decontaminant.
- Contact the cognizant industrial hygiene office to test the decontaminated area and equipment for residual mercury.

## Mercury Disposal

Mercury and mercury compounds will not be dumped into any body of water including open seas or oceans, or intentionally released into any ship's waste disposal system. Shipboard mercury storage and handling areas should not be connected to deck drainage systems.

For shipboard only, all mercury-contaminated waste, including scrap amalgam, will be collected, and packaged with a **double boundary** of confinement using plastic bags, sealable drums, or polyethylene bottles and labeled.

For shore facilities, dispose packaged mercury waste in cooperation with the base environmental public works department.

Special disposal procedures are **not** required for items contaminated with trace amounts of mercury, such as used disposable amalgam capsules. **Reclose** amalgam capsules after use, or seal used capsules in a denture bag.

## BURNS

The major causes of burns are inattentiveness and rushing through a task. Two types of burns are possible in DTFs—thermal and chemical. Whether thermal or chemical, burns are injuries that can be avoided by exercising caution.

### Thermal

Thermal burns are caused by open flames and hot surfaces. Common dental items using open flames are Bunsen burners and torches. Dental items that may be

hot include compound and wax heaters, sterilizers, and items in the sterilizers, such as instruments. Constant awareness of the use, condition, and location of these items is essential to prevent thermal injury. Equipment should be located in an area convenient for use while minimizing the chance of accidental burns. Flames are difficult to see, so make a habit of keeping them away from flammable liquids, materials, and yourself. Always use heat-resistant gloves or the device supplied by the manufacturer to remove items from sterilizers. Always allow sterilized items to cool before using. Items should never be taken out of the sterilizer and placed directly on the instrument tray for use or placed directly into a patient's mouth.

### Chemical

Chemical burns result from contact with a caustic agent, whereas, damage from thermal burns cease when the heat source is removed. Chemical burns may continue below the skin long after removing the agent from the skin's surface. A caustic chemical burn must be neutralized. When handling caustic chemicals, you should know what the neutralizer is and where it is located. Often, the neutralizer cannot penetrate the skin with the same efficiency as the caustic agent. Immediate treatment by professional medical personnel is essential.

Chemical burns of the eyes and skin can result from careless use of many materials such as etchant acids, radiographic solutions, endodontic materials, and bleaching agents. Protective eyewear should always be worn when handling hazardous liquid chemicals for protection against splash hazards. Proper storage of chemicals is critical for safety.

## ADDITIONAL HAZARDS IN THE DENTAL ENVIRONMENT

Additional hazards or safety items are associated with the dental environment. This includes allergens and sensitizing agents, visible light, injury by projectiles, noise, and psychological effects.

### Allergens and Sensitizing Agents

Many patients or personnel may be allergic to one or more of the materials used in the DTF. Other individuals may develop allergies or sensitivities from the use or misuse of materials. Dust from poor housekeeping, grinding, or buffing and polishing can become hazards. Chemicals in medicaments or disinfectants, sterilizer solutions, formalin, solvents, acrylic resins, impression materials, radiographic solutions, waxes, cements, unset composites, and

sealants are just a few of the many chemical agents that could become hazards.

## Visible Light

The use of photo-initiated dental materials has increased dramatically. Many restorative resins, bases/liners, impression materials, and periodontal dressings are now visible light polymerized materials. Repeated exposure to the curing light from the visible light polymerization unit can cause damage to the retina. You should use protective filtering lenses, goggles, or shields when using visible light polymerization procedures. It is also recommended that you do not stare at the light source or reflected light during the polymerization period.

## Injury by Projectiles

Patients and staff members can be injured by projectiles or debris generated by cutting, scaling, polishing, or irrigating procedures. Aspiration of projectiles by the patient is also a possible hazard. Actions that prevent projectile injuries include using rubber dams and wearing protective eyeglasses or goggles.

## Noise

In the DTF, several devices have the potential to produce noise levels that may cause a hearing loss in exposed personnel. The potential for hearing loss is directly related to the intensity of the noise, the duration of the exposure, and the sensitivity of the individual. The proper use and maintenance of equipment and the proper use of hearing protection, when appropriate, are all important to prevent unnecessary exposure to hazardous noise and the potential for occupational hearing loss.

## Psychological Affects

Some aspects of the dental environment have psychological affects on staff and patients. Every effort should be made to maximize the positive psychological affects by optimal use of such interior design features as lighting, wall color, texture, and decoration, furnishings, and floor coverings.

## DENTAL EQUIPMENT

It's important for you to understand that as a dental assistant, you are **not** expected to assume the role of a Dental Equipment Technician (DET). The DET has a Navy Enlisted Classification Code of DT-8732 and is

trained to maintain and repair mechanical, electro-mechanical, and electronic dental equipment; and perform preventive maintenance and electrical safety testing on dental equipment.

To be an effective dental assistant, you must be familiar with the equipment in the DTR. You are expected to:

- Recognize the major components of each piece of equipment.
- Operate each piece of equipment.
- Perform routine user maintenance on equipment.

The **first rule** for operating and performing user maintenance on equipment is to carefully read the manufacturer's instructions. Copies of this literature should be in the LPO/LCPO's office, or contact the Dental Equipment Repair Division.

## TERMINOLOGY AND DEFINITIONS

- **Biomedical and Facilities Systems (BIOFACS)**—A centrally-managed automated preventive maintenance system for use by DETs.
- **Dental Equipment**—Consists of devices used in the dental diagnosis, therapy, and treatment of injury or disease. This equipment consists primarily of Federal Supply Classification (FSC) 6500 items. It also consists of similar commercial, nonstandard items used in dental treatment facilities to provide patient care.
- **Types of Maintenance Requirements (MRs)**—The three types of MRs are as follows:
  - Preventive maintenance (PM)**—Often called scheduled maintenance, serves to ensure inherent reliability, increase operational availability, and prevent excessive wear of moving parts.
  - Unscheduled maintenance (UM)**—Often referred to as corrective maintenance for the repair of equipment breakage or malfunctions.
  - No maintenance required (NMR)**—Applies to equipment that normally requires no scheduled maintenance.
- **Maintenance Levels**—The three maintenance levels are as follows:
  - Level I (performance testing)**—Organizational maintenance consists of

operator maintenance that is performed before, during, and after equipment usage. It is the basic maintenance required to keep equipment operating on a daily basis. Procedures usually consist of maintaining fluid levels, simple lubrication, daily inspections, cleaning, and operator calibration checks and adjustments.

—Level II (preventive maintenance)—Intermediate maintenance relates to scheduled periodic (planned) technical inspection, lubrications requiring disassembly, replacement of worn or deteriorated parts, interior cleaning, calibration verification or adjustment, and verification of Level I performance. Level II maintenance is to be performed by a DET or contracted service.

—Level III—Maintenance consists of maintenance requiring complete overhaul of the item of equipment and is considered depot-level maintenance or equipment manufacturer service center level maintenance. At command discretion, performance of Level III is permitted if parts, personnel with technical expertise, tools, and test equipment, and manhours are available. Level III maintenance will usually result in extension of service life and should be documented in the appropriate service history.

## **MAINTENANCE WORK ORDERS**

The Medical/Dental Maintenance Work Order (NAVMED 6700/4) shown in figure 11-1, or BIOFACS work orders are used to determine workload and assign priorities for the DETs. Dental technicians who have equipment that does not properly function will complete the top section of the NAVMED 6700/4. The form is then turned in to the dental repair department for action. Depending upon the DETs' workload, they may assign you a functioning piece of equipment on a loan basis until the equipment repairs are completed.

## **DENTAL DELIVERY SYSTEM**

The operation and maintenance of the dental delivery system (DDS) which consists of a chair, unit, and light (fig. 11-2) are critical to the performance of dentistry. You must know how to properly use, maintain, and make minor adjustments to a dental chair, unit, and light to avoid unnecessary delays. Because of the many different makes and models used in Navy dentistry, always read the manufacturer's

instructions on the operation and maintenance for the make and model of the equipment you are using. Procedures for chemical disinfection of the DDS are discussed in *Dental Technician, Volume I*, Chapter 10, "Sterilization and Disinfection."

## **DENTAL CHAIR**

As the dental assistant, it is your responsibility to seat the patient and make chair adjustments smoothly, and assure the patient is placed in the correct position for treatment and is comfortable.

### **Operation**

Begin each day by making a visual inspection and an operational check of the dental chair. The dental chair is electronically controlled and hydraulically powered. An electronic motor drives the hydraulic pumps enabling the back of the chair to tilt and the base of the chair to lift. The movements are controlled by switches located on the back of the chair. More recent models use foot controls for infection control purposes.

Most dental chairs have movable armrests that either slide back or raise up to provide easier patient entry and exit. Generally, some form of a release button locks and unlocks the armrest. A swivel/brake device allows the dental chair to rotate to approximately 45 degrees from either side of the center and then lock into position.

Dental chairs are equipped with either an articulating or a horseshoe-style headrest (fig. 11-3). The articulating headrest allows you to move the patient's head in approximately a 60° arc. It is adjusted by a release button located on the backside of the headrest. The horseshoe-style headrest is adjusted by pushing or pulling down on the headrest. The horseshoe headrest may also have an adjustable strap on the backside to make up and down movements of the horseshoe.

### **Securing the Dental Delivery System**

Procedures for securing the dental delivery system are as follows:

- Place chair in the lowest position.
- Raise the back to the upright position.
- Place the armrest in the locked position.
- Turn off the master switch.

# MEDICAL/DENTAL MAINTENANCE WORK ORDER

Date of request		For additional Information call: Ext:			
		Name:			
Requesting Activity		PM no.		PA or minor property no.	
Location of equipment: Rm, Dept, etc.				Name of equipment to be repaired	
Manufacturer		Model no.		Serial no.	
				MIP no. (for ships)	
Description of work requested in your own words:					
FOR SHOP USE ONLY					
Date parts: Ordered      Received		Reqn or purchase order nos.			Work/Job order no.
PARTS USED					
NSN or Mfg's part #		Nomenclature			Cost
					Quantity
Manhours:		Description of work performed/remarks:			
BMET/DETR      Date      HRS					
Total manhours					
Date job completed:					
Maint contract in effect					
Yes <input type="checkbox"/> No <input type="checkbox"/>					
Warranty in effect					
Yes <input type="checkbox"/> No <input type="checkbox"/>					
Work assigned to:				Note: This information is to be transferred to the NAVMED 6700/3 or the Automatic Data PM record.	
RECEIVED IN SHOP				OUT OF SHOP	
Signature:		Date:		Returned to Requesting activity.	
				Date:      Signature:	

NAVMED 6700/4 (Rev. 7-81) S/N 0105-LF-206-7020

DTB1f1101

Figure 11-1.—Medical/Dental Maintenance Work Order, NAVMED 6700/4.

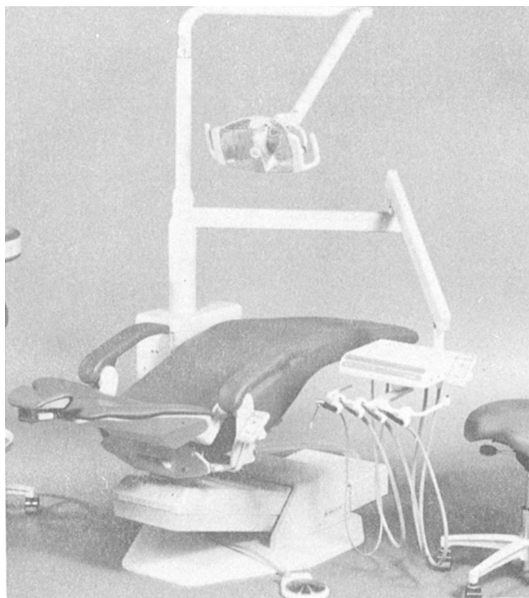


Figure 11-2.—Dental chair, unit, and light.

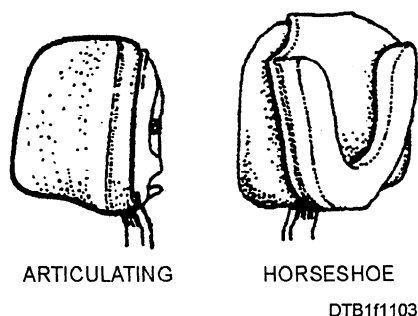


Figure 11-3.—Headrest styles.

## Level I Maintenance

Perform the following Level I maintenance on the dental delivery systems:

- Perform an operational check before seating your first patient of the day.
- Look for air, water, and oil leaks and broken or missing parts.
- Ensure the exterior surface is clean and the upholstery is in good condition, with no tears or other damage.
- Clean the chair daily with a soft cloth dampened with soapy water. Dry the chair thoroughly with a clean soft cloth.

## DENTAL UNIT

Two types of dental units used in Navy dentistry are the mobile and chair-mounted types. The

chair-mounted is the most common type in use. Most units provide the basic utilities for dental treatment including water, compressed air, electricity, and vacuum. It may also include handpiece controls, foot controls, a bracket tray, tubing flush system, 3-way syringes, cuspidor, and a suction apparatus. The unit should be designed so that it is compact and doesn't occupy space needed by the assistant. Hose-attached equipment, such as handpieces, syringes, and oral evacuation devices, should be conveniently positioned to both the provider and the assistant.

## Operation

As with the dental chair, begin each day by making a visual inspection and operational check of the unit. During the inspection, first look for obvious problem areas, such as frayed electrical wiring, missing screws, and water leaks. Then conduct an operational check for each system. For example, you can test the water, air, electrical, and vacuum systems by operating the 3-way syringe, fiber-optic handpiece, dental light, and saliva ejector.

## Water System

Many dental units operate with water that comes from the clinic's main water line. With the emphasis on infection control and the advances in dental equipment, the Navy is replacing older dental units and purchasing new units that have self-contained water systems. A malfunctioning water system affects the operation of the 3-way syringe, cuspidor, cup filler, and handpiece water spray. If any of these items fail to work, first make sure that the necessary valves and switches are turned on. If you can't solve the problem at this point, read the manufacturer's instructions before continuing. Water leaks are usually the result of loose connections or defective washers and valves. When necessary, have the DET replace any defective parts.

The new self-contained water systems are designed so you can optimize the quality of your dental unit water. The benefits from this system only occur when periodic system flushing and disinfection procedures are followed. Failure to follow the procedures for the type of self-contained water system you use may expose patients to water with higher than normal microbe counts. Most systems can use either tap, distilled, or sterile water to operate. Do not use saline solutions, mouthrinses, or any chemical solutions. These solutions may damage the water



system components and cause the failure of your dental unit. A 750ml bottle constructed of polyethylene plastic is used to hold the water for the system. The bottle cannot be heat sterilized, but can be sterilized using ethylene oxide. Before attempting to use a self-contained water system, read the manufacturer's instructions for operation and maintenance.

## Air System

A large central air compressor in your clinic provides compressed air. This enables most dental units to operate up to three dental handpieces and the 3-way syringe. Because of the noise level and for safety reasons, this system is located outside of the patient treatment area.

Most dental handpieces operate on air pressure within 20- to 80- pounds per square inch (psi) range, with a specific pressure recommended for each handpiece. Most units have a type of control system located on the bracket tray where air pressure can be adjusted. If you locate any air leaks, have a DET correct them as soon as possible.

## Electrical System

Probably the most complex system on a dental unit is the electrical system. When there is a problem with this system, report it to the DET. Among the items affected by a dental unit's electrical system are the water heaters and solenoids (electrically operated switches).

## Central Vacuum System

Generally, a central vacuum system provides suction to numerous dental units. The vacuum is connected to the unit with hoses and oral evacuation equipment, such as high-volume evacuator (HVE) and saliva ejector. A filtering component of the central vacuum for both the HVE and saliva ejector is the solids separator (fig 11-4). It contains a strainer which collects large pieces of debris that could clog suction hoses. At least once a week or if a decrease in vacuum is detected, remove and clean the strainer. This ensures proper suction from the central vacuum and maintains proper DTR infection control.

**HIGH-VOLUME EVACUATOR.**—The water spray from the handpieces and three-way syringes, along with debris from the patient's mouth, must be removed. The most efficient way to do this is with an

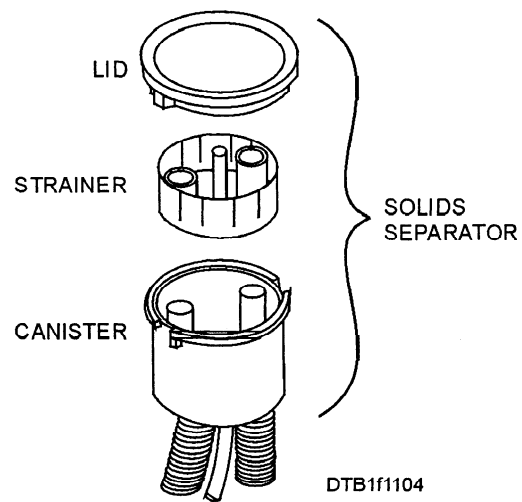


Figure 11-4.—Solids separator.

HVE (fig 11-5). The principle of this evacuator is low pressure and high volume. A tip is placed into the HVE handpiece and the suction turned off and on by a control valve or button on the handle. Some of the newer models of HVEs have a quick disconnect device and are now autoclavable. Follow the manufacturer's instructions for maintenance.

**SALIVA EJECTOR.**—During certain procedures, the provider may choose to keep the working site dry by using the saliva ejector. This type of suction is effective only when there is a limited amount of fluids, such as saliva, to remove from the patient's mouth. It can also be used to hold the tongue away from the working site and keep an area dry for placement of material that takes a long time to set. A disposable plastic saliva tip inserts into the rubber end of the saliva ejector assembly and is turned on/off by a control valve. Follow the manufacturer's instructions for maintenance.

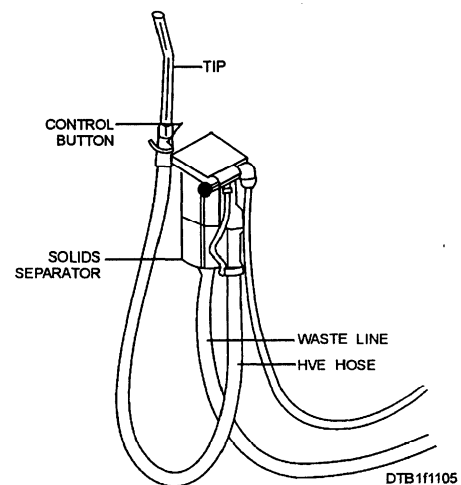


Figure 11-5.—High-volume evacuator (HVE).

## Control System

This system delivers the drive air and coolant to whichever handpiece is lifted from the dental unit. The control system is made up of two parts: handpiece controls and a foot control.

**HANDPIECE CONTROLS.**—Most handpiece controls are located on the bracket tray that can accommodate three handpieces (fig. 11-6). The water coolant flow and maximum drive pressure are individually adjustable for each handpiece.

Most units use the following international symbols:

- A blue dot identifies a water control.
- A yellow dot identifies an air control.
- A red dot identifies the ON or active position.

Every dental unit has a master ON-OFF toggle or switch. It turns on the air and water to the control system. When it is turned off, none of the items on the unit will function. This switch should be OFF whenever the unit is not in use to prevent flooding in the event of a leak while the system is unattended. The ON/OFF indicator provides a visual indication that the system is pressurized when the master switch is ON.

**HANDPIECE HOSES.**—The handpiece hose is attached to a coupling that joins the handpiece to the hose. Never over-tighten the coupling. Under-tightening

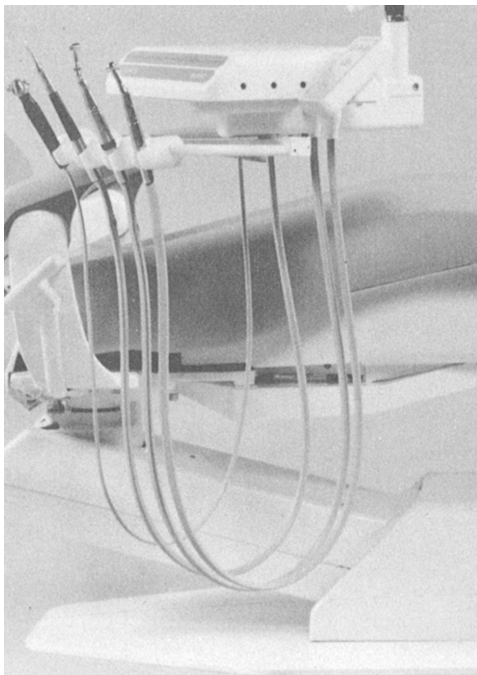


Figure 11-6.—Handpiece controls.

can cause air and waterleaks. Many providers use a “quick disconnect” that attaches to the coupling. By gently pulling on the handpiece, the operator is able to change handpieces very quickly. The quick disconnect is also available with a 360° swivel that allows the handpiece to be turned around without tangling up the hoses. Perform a daily operational check on the quick disconnect equipment. Inspect “O” rings and replace them if found frayed or missing.

**FOOT CONTROL.**—All handpieces are operated by the provider through the use of a foot control (rheostat) device. A valve inside the foot control regulates the handpiece speed and provides an air signal that activates the air and water coolant flow. The foot control is operated by light foot pressure applied to any part of the disk. Some foot controls may also be equipped with a wet/dry toggle switch and a chip blower. The wet/dry toggle switch can shut off the water coolant to the handpiece without moving the hands from the treatment area. The chip blower sends a jet of air through the handpiece when not in use to remove any debris accumulated in the treatment site.

## Other Controls

The other controls that could be on the bracket table and assembly, depending on the make and model, are as follows:

**WATER COOLANT ON/OFF TOGGLE**—Stops the flow of water coolant to all handpieces.

**AIR COOLANT FLOW CONTROL**—Adjusts the air coolant flow to all handpieces and can completely shut off the air coolant.

**DRIVE AIR PRESSURE CONTROL**—Adjusts the drive air pressure to the handpiece with an adjustment screw for each handpiece.

**SYRINGE FLOW CONTROL**—Adjusts the air and water flow from the three-way syringe.

**AUTOMATIC HANDPIECE HOLDER**—Shuts off air and water to the handpiece when it is in the holder.

**HANDPIECE TUBING FLUSH SYSTEM**—Some newer models of dental units have a handpiece tubing flush system that quickly and thoroughly flushes the handpieces to wash away contaminants accumulated in the handpiece and tubing. This system saves wear on the handpieces by sending water directly to the handpiece, and bypassing the control block and not requiring the handpiece turbine to operate. Flush the handpieces at the beginning of each day for 1

minute, after each patient, and at the end of the workday for 30 seconds following BUMEDINST 6600.10.

**THREE-WAY SYRINGES**—Each dental unit has at least one 3-way syringe that provides a stream of (1) air, (2) water, or (3) a combination spray of air and water. Many of the new syringes have a quick disconnect that allows the syringe tip to be changed for each patient and is autoclavable. The water temperature control, if equipped, on the dental unit, can be adjusted to keep the temperature of the water at approximately 130°F.

## DENTAL LIGHT

The dental light (fig. 11-7) illuminates the patient's mouth and treatment area. It may be on a ceiling track or mounted to the DDS. The light should be properly positioned 30-36 inches from the patient's face. Most dental lights mounted to the DDS consist of three major assemblies: the transformer and rigid arm assembly, flex arm assembly, and the light head assembly. The intensity switch located on the transformer housing is used to set the intensity of the light to low, medium, or high settings.

The dental light head rotates on three different axes. It can rotate as much as 180° horizontally, 125° vertically, and 45° diagonally from either side.

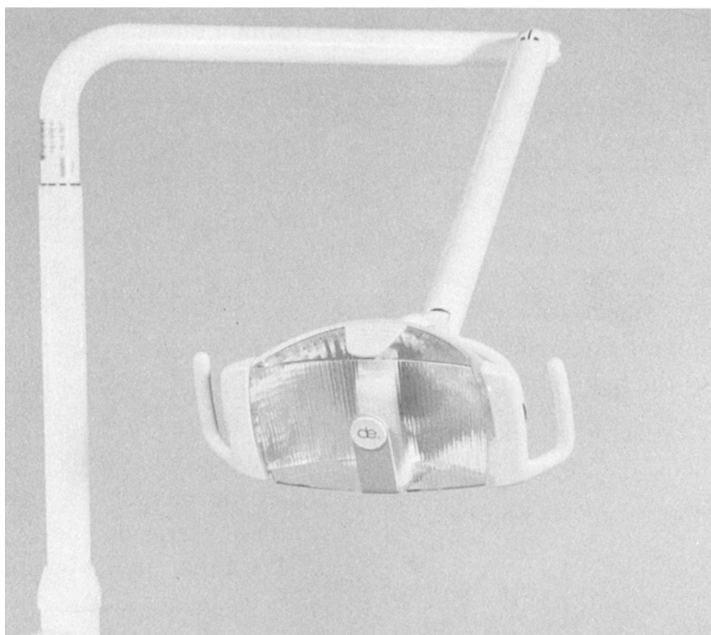
To perform a daily operational check on the dental light.

- Turn light on.
- Move light ensuring a free full range of motion.
- Light should not drift. If drifting is discovered, initiate a repair request

## Light Replacement

Often, at the most inconvenient time, the bulb in the dental light burns out. To avoid further delays, you need to know how to quickly and properly replace the bulb. Use the following steps to change a bulb:

- Turn the light switch to the off position and allow the bulb to cool.
- Release the fastening devices on the light shield and move the shield aside.
- Use a gauze pad or cloth to protect your fingers when removing the bulb. Very carefully pull the old bulb from the socket and discard it.
- Most units have a spare bulb compartment on the light assembly. Open the wrapper of the new bulb to expose the bulb pins, but do not remove the bulb from the wrapper.
- Use the wrapper to protect the bulb #while installing it. This is necessary because finger oils limit bulb life and can affect light performance.



**Figure 11-7.—Dental light.**

- If you do touch the bulb by mistake, gently clean it with cotton soaked in ethyl alcohol.
- Carefully insert the new bulb into the socket and remove the wrapper.

### **CAUTION**

Never operate the dental light with the light shield removed. The shield is your protection against injury if the bulb shatters.

- Replace the light shield, and test the dental light to ensure it works properly.
- Notify the dental repair department to replace the spare light bulb you used, or if the light does not begin to function properly.

## **Light Shield**

The light shield is constructed of hard plastic and is used to protect the dental light bulb and the reflector. Because the dental light is close to the patient treatment area, it is frequently soiled by splatter and aerosols. Use the following steps to clean the light shield:

- Ensure the light has cooled before cleaning the light shield.
- Release the fastening devices on the dental light to remove the light shield.
- Immerse the shield in warm, soapy water, rinse in clear water, and then wipe dry with a lint-free cloth.
- When the shield is clean, replace it on the dental light and test for proper operation.

## **Light Reflector**

The light reflector is constructed of glass and is protected by the light shield. Use the following steps to clean the inside surface of the reflector when dust or spots reduce the efficiency of the light:

- Allow the light and reflector to cool before removing the light shield.
- Use a soft, lint-free cloth to gently remove any accumulated dust particles.
- Unplug the DDS or dental light. Use a dampened cloth with water or a diluted solution of mild dishwashing soap for a more thorough

cleaning. Ensure the cloth is not so wet that it drips into the electrical parts of the light.

- Wipe the inside surface of the reflector in one direction only. Ensure no residue remains on the reflector.
- Never use abrasives or chlorine on the surface of the reflector. Doing so can damage or discolor the surface of the reflector, causing poor lighting.
- Do not rub heavily or clean the reflector when it is hot. Never soak the reflector in cleaning solutions.
- After cleaning is completed, replace the light shield and test for proper operation.

## **DENTAL HANDPIECES**

A dental handpiece is a precision-built mechanical device designed for use with rotary instruments, such as burs, stones, wheels, and discs, used in dental treatment. Handpieces may be air driven, electric, or compressed gas (for surgical handpieces). Surgical handpieces are discussed in *Dental Technician, Volume 2*, Chapter 5, “Oral Surgery Assistance.”

Handpieces can be classified according to the revolutions per minute (rpm) or speed at which they operate. One type is the low- or slow-speed, and the other is referred to as the high-speed contra-angle.

Both the low- and high-speed handpieces use an air system to operate several parts of the handpiece. The main function of the air is to rotate the air turbine or vane drive. Basically, this means the air system is the main power source for these handpieces.

Fiber optic accessories attached to dental handpieces allow the provider to operate handpieces with a light source and is discussed in this section.

## **CONTRA-ANGLE HANDPIECES**

This type of handpiece is used in cavity preparations to remove the bulk of enamel, dentin, and old metal restorations. It is also used to prepare retention grooves and bevels with a cavity preparation and to develop the cavity outline. The high-speed contra-angle handpieces (fig. 11-8) turn at a higher rate of speed than the slow-speed handpieces. Its speed ranges from 380,000 to 400,000 rpm depending on the model. High-speed handpieces are operated by air pressure. The term *contra-angle* describes the angle at

the head of the handpiece. The contra-angle allows for easy access to treatment sites. Straight designed high-speed handpieces are available, but the contra-angle is the most commonly used in restorative procedures. Before you use one, consult the appropriate manufacturer's instructions.

The high-speed handpieces are designed to use smooth shank burs that are 1/2-inch in length. All models work on the same basic principle: Burs are inserted into a plastic or metal friction chuck and held tight in the handpiece by either manual tightening or a power lever lock. The bur is rotated when air is forced through the airports into the head of the handpiece and to the air turbine.

The high-speed handpiece uses a water system to keep the handpiece cool. The water system also produces a fine spray mist, which aids in flushing debris from the treatment site. **Constant preventive maintenance is essential in caring for handpieces.** If they are **not** properly cleaned and lubricated, abrasives, such as finely ground tooth, metal, and other particles, will cause excessive wear and undue vibration. The proper lubrication of handpieces is of such importance that it **cannot** be overstressed. Read and follow the manufacturer's instructions to make sure that you understand the **lubrication, cleaning,**

and **sterilization** requirements. Perform the necessary maintenance as recommended. It takes only a few seconds to ruin a handpiece that has been improperly or insufficiently lubricated, cleaned, or sterilized. Always ensure your handpieces meet the required infection control standards as outlined in BUMEDINST 6600.10, *Dental Infection Control Program*.

## LOW- OR SLOW-SPEED HANDPIECES

This type of handpiece is used for removing caries, refining a cavity preparation, and performing a prophylaxis.

The low-speed handpiece consists of a motor or power driven unit (fig. 11-9) and various attachments (fig. 11-10). The speed of the motor ranges from 0 to 5,000, or 80,000 rpm depending on the model.

The head of the handpiece attachment contains a chuck into which a dental bur or other rotary instrument is fitted. Most heads contain a latch-type chuck. Some heads contain a friction-grip chuck. On the slow-speed motor is a speed control ring. By turning this ring, you can control the speed with which a bur rotates and its direction of rotation.

Many units and models have some method of quickly connecting and disconnecting the motor and attachments. Some models have a quick ring disconnect, while others have a button to depress or an indicator to press. As with the high-speed handpiece, read and follow the manufacturer's instructions for operation, lubrication, cleaning, and sterilization requirements for the slow-speed motor and attachments.

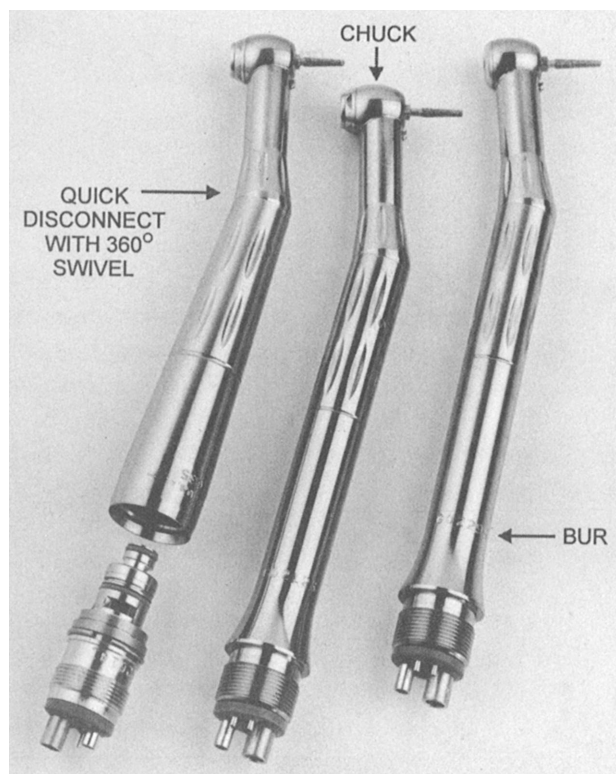


Figure 11-8.—High-speed contra-angle handpiece.

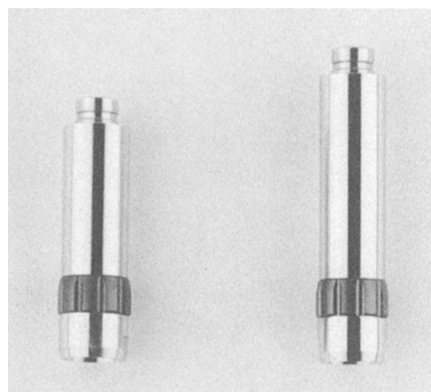
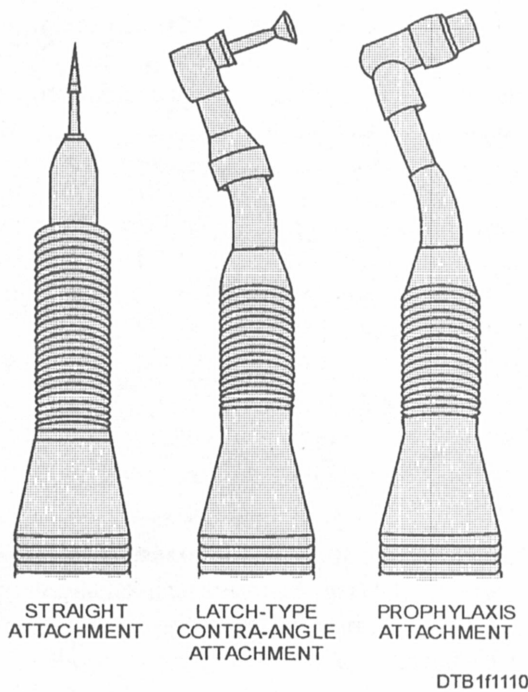


Figure 11-9.—Slow-speed motor.



**Figure 11-10.—Selection of attachments for the slow-speed handpiece, including (from left) straight, latch-type contra-angle, and prophylaxis attachment.**

## FIBER OPTIC ACCESSORIES

Fiber optic accessories provide the operator a source of artificial illumination through the dental handpiece. The clinical applications of a fiber optic handpiece are almost limitless. It is useful in general inspection and transillumination of the oral cavity and tooth structure to help identify and diagnose inter-proximal caries, stains, decay, calculus, crazing and hair line cracks in natural and artificial teeth, location of excess cement, and smoothness of crown preparations.

Most fiber optic systems are activated by touch or an air-electric switch. Many systems also have an intensity control that permits adjustment of the light intensity to suit individual preferences and needs.

Fiber optic technology involves the transmission of light through long, thin fibers of glass or transparent material. The light travels, nonelectrically, through the fiber by reflecting from wall to wall without transmitting or generating heat. This makes fiber optics completely safe for use in the oral cavity.

Each individual fiber is approximately 25 microns in diameter, or about 1/3 the size of human hair. A cluster of fibers is called a fiber optic bundle. The bundles are enclosed inside the handpiece and

positioned to direct the light along the same line as the dental bur.

Level I maintenance on the fiber optic system is to clean the fiber optic surfaces on both ends of the handpiece after each patient. To do this, wet a cotton swab with isopropyl alcohol and clean both ends before the sterilization cycle. This prevents residual debris and handpiece lubricant from baking onto the fiber optic surfaces, which results in reduced light output. Read the manufacturer's instructions for additional care, maintenance, and bulb replacement requirements.

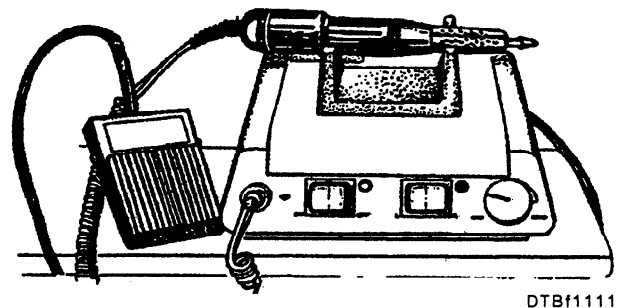
## ELECTRIC HANDPIECE

This type of handpiece attaches directly to a small electric motor and is normally used in the prosthetic lab. The electric handpiece is portable, lightweight, and has variable speeds of 2,500 to 25,000 rpm (fig. 11-11). Units are initially activated by an on/off switch and controlled by a foot switch. Another switch controls the left or right torque action similar to the forward and reverse of the low-speed handpiece. The electric handpiece uses long, smooth-shanked rotary instruments.

Electric handpieces require minimal maintenance and adjustments. Consult the manufacturer's instructions for specific requirements and guidelines.

## IDENTIFYING ROTARY INSTRUMENTS

Rotary instruments are used in conjunction with dental handpieces. The rotary instrument group includes a great number of small, separate items. These instruments are made from many materials and combinations of materials ranging from diamonds to very finely detailed steel. Rotary instruments have many uses, such as preparing cavities, finishing restorations, trimming dentures, polishing teeth, and removing bone during oral surgery. Rotary instruments are a vital part of most dental treatment



**Figure 11-11.—Electric handpiece.**

procedures. Your role with this group ranges from keeping an adequate number of rotary instruments in the treatment room to changing them in the handpiece.

## Basic Rotary Instruments

Rotary instruments, such as burs, have three basic parts: head, neck, and shank (fig. 11-12). The head of the bur is the working or cutting portion, which is made in many sizes and shapes. The neck, which is the narrow portion of the bur connects the shank and the head. The part of the bur that fits into the handpiece is the shank. The length of the shank depends on the specific use of the bur, whereas the shape of the shank is designed to fit into a specific handpiece.

We have already discussed the several types of handpieces used in dentistry. Each rotary instrument is used in a particular handpiece. To indicate in which handpiece the rotary instruments function, they have been classed as friction grip, straight handpiece, or latch contra-angle handpiece types (fig. 11-13). The friction grip (FG) instruments are abbreviated as FG and are used in high-speed handpieces and friction grip low-speed contra-angles. These burs have small, smooth shanks that are held in the handpiece by friction against a metal or plastic chuck, or by a wrench-tightened metal chuck. Friction grip burs are available in short shank and miniature (pediatric), as well as the commonly used standard length.

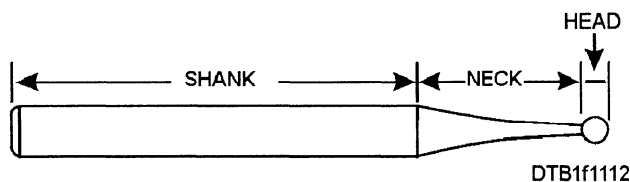


Figure 11-12.—Bur parts and basic shank designs.

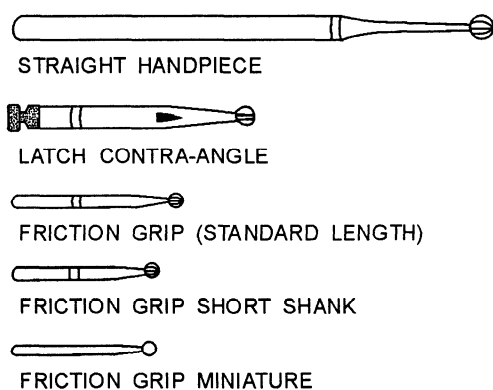


Figure 11-13.—Classification of rotary instruments

The straight handpiece rotary instruments are abbreviated as **(SHP)**. They are used in electric straight handpieces and in slow-speed, air driven straight handpieces. The shank on the straight handpiece instruments is larger in diameter than the FG shank and at least twice as long.

The latch contra-angle handpiece instrument is identified as angled handpiece **(AHP)** or latch-angle **(LA)**. This instrument is used in conventional latch contra-angle handpieces. Common AHP rotary instruments have a notched shanked with the same diameter as the SHP instruments but are about half the length. However, some AHP instruments are made with short or long shanks.

Dental burs are available in many shapes and sizes. The basic shapes of bur heads are the round, inverted, pear-shaped, end and side cutting, straight/tapered plain fissure, and tapered/straight crosscut fissure as shown in figure 11-14.

Burs are made of either steel or carbide. Steel burs are used in the slow-speed handpiece and dull after only one use when cutting enamel of teeth and should be discarded after use or when directed by the dentist. Steel burs being used on dentin under slow-speed often generate heat in the tissue of the tooth, causing discomfort to the patient. The dentist will use the very lowest speed to reduce the chance of heat and discomfort.

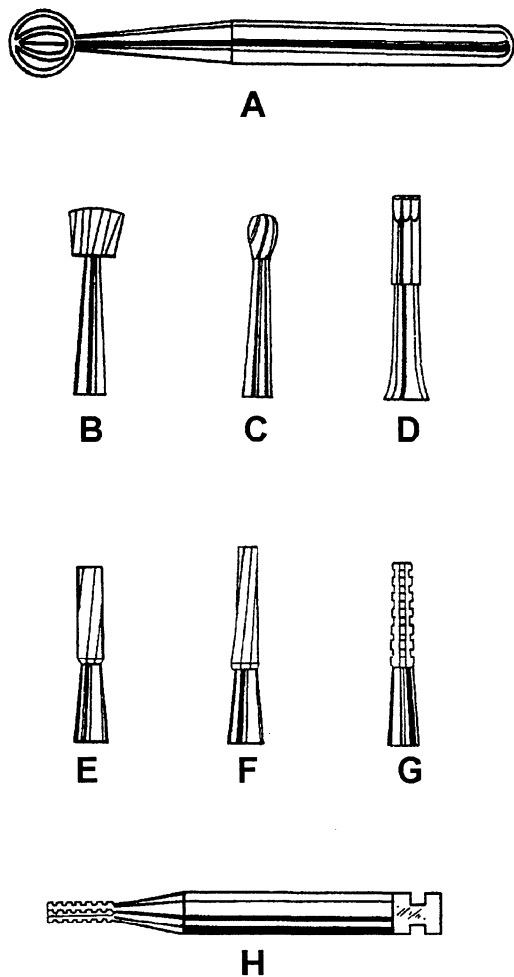
High-speed handpieces use a carbide bur. Because of its hardness, the carbide bur can be used many times to cut hard enamel tooth structure without becoming dull. However, carbide burs are brittle and have a tendency to fracture under pressure. The carbide bur operates most efficiently at high speeds with light pressure.

## TYPES, USE, AND MAINTENANCE OF MISCELLANEOUS EQUIPMENT

Several pieces of equipment are commonly used in many dental specialties. These items include provider and assistant mobile chairs, amalgamators, and visible light curing units.

## PROVIDER AND ASSISTANT MOBILE CHAIRS

Provider and assistant mobile chairs play an important role in the practice of dentistry because of techniques that require both the provider and assistant to work from seated positions. The doctor's or

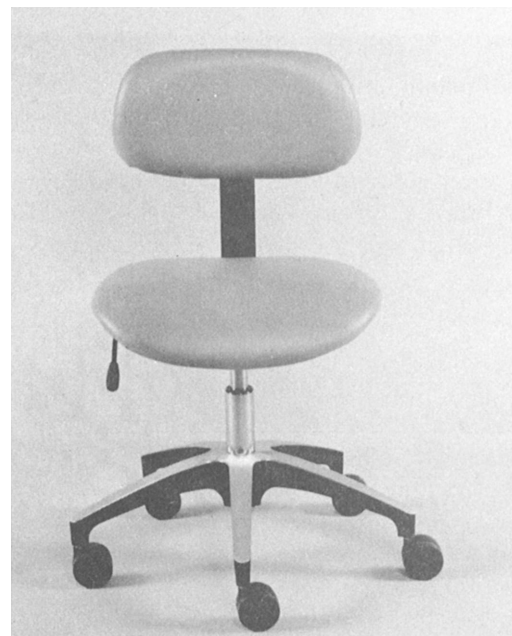


- A. ROUND (NOS. 1/4, 1/2, 2, 4, 6, 8)
- B. INVERTED CONE (NOS. 33 1/2, 34, 35, 37, 39)
- C. PEAR SHAPED (NO. 330)
- D. END AND SIDE CUTTING (NO. 901)
- E. STRAIGHT PLAIN FISSURE (NOS. 56, 57)
- F. TAPERED PLAIN FISSURE (NOS. 169, 170)
- G. TAPERED CROSSCUT FISSURE (NOS. 699, 700, 701, 702, 703)
- H. STRAIGHT CROSSCUT FISSURE (NOS. 557, 558, 559)

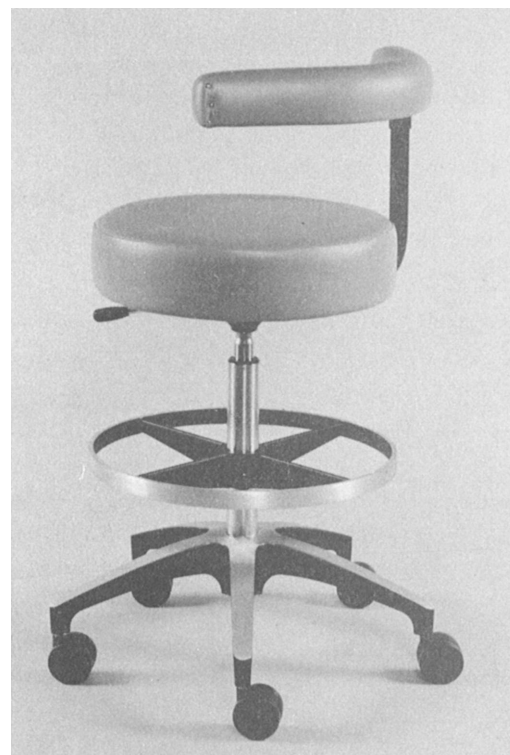
DTB1f1114

**Figure 11-14.—Basic bur head shapes and sizes.**

provider's chair is designed with an adjustable backrest (fig. 11-15). The assistant's chair on the other hand, has an adjustable armrest that wraps around to the front of the chair (fig. 11-16). Chairs for both the provider and the assistant should be well-padded and comfortable. They both must have adjustable seat height, as well as a broad base to give stability. Normally, chairs with at least four to five casters are preferred. The chair should have a foot support ring so that the users can keep their feet parallel to the floor, thereby maintaining comfort and proper posture.



**Figure 11-15.—Provider's mobile chair.**



**Figure 11-16.—Assistant's mobile chair.**

Level I maintenance on mobile chairs consists of making adjustments, lubricating the caster bearings, and cleaning. The adjustments involve seat height and backrest or armrest positions. Lubricate the caster bearings with light-weight machine oil monthly. **Never** lubricate the single shaft on these chairs,



because doing so would keep the locking mechanism from holding its adjusted position. Be sure to routinely clean the chair seat and backrest or armrest since these areas often become soiled.

## MOBILE DENTAL CABINETS/CARTS

Your DTR may be equipped with wall-mounted cabinets, mobile cabinets/carts, or a combination of both. They provide the working surface when assisting with dental procedures. Because of infection control, and possible contamination, only disposable or sterilizable items should be placed on the working surfaces. All other items, such as floss dispensers, sharps containers, and miscellaneous equipment and supplies should be stored near by, but out of the field of operation.

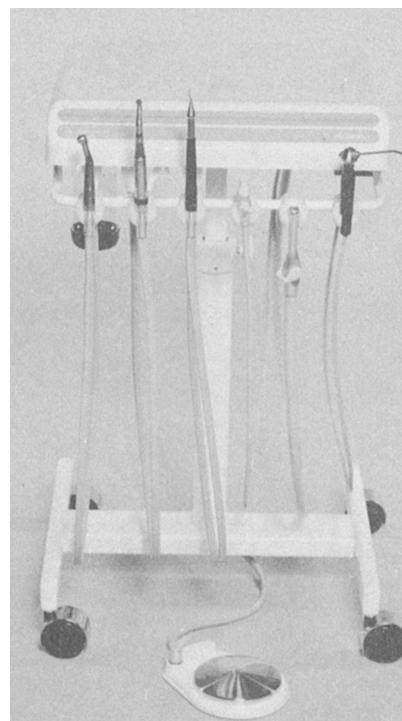
Mobile dental cabinets and carts are used to store dental instruments and materials with the top of the cabinet or cart serving as a working surface. Figure 11-17 illustrates a typical mobile cabinet, while figure 11-18 illustrates a mobile dental cart.

The mobile dental cabinet has castors that are on the bottom of the unit. It usually has four drawers and a top that can slide from either front to back or side to side. A recessed area under the movable top provides deep space to store larger items. The drawers provide space for any instruments, supplies, and materials such as topical and local anesthetic, rubber dam equipment, bases, and cements.

The mobile dental cart provides a working surface and can have various attachments for handpieces, the HVE system, and a saliva ejector if equipped.



**Figure 11-17.—Mobile dental cabinet.**



**Figure 11-18.—Mobile dental cart.**

Follow the infection control guidelines for disinfection of cabinets and carts.

## AMALGAMATORS

An amalgamator is a device used to triturate or mix mercury and amalgam alloy. It has a small electric motor that rotates the forked prongs holding the amalgam capsule in place. Ensure the cover is closed over the forked prongs before the amalgamator is activated to prevent mercury vapors from escaping. The forked prongs move in a figure “8” to triturate the amalgam alloy. Most amalgamators have a variable speed control and timer dials (fig. 11-19). Some newer models use a micro-processor computerized amalgamator that uses magnetic cards to set mixing times. By using various capsules and settings, other materials such as some dental cements can be mixed.

It’s important to keep the amalgamator clean. The newer models in use today have an enclosed area in the prong area so the capsules cannot drop down inside the unit. The older models do not have an enclosed area and capsules can fall down inside the unit. If this occurs, first unplug the unit and then you can attempt to retrieve the capsules with a pair of hemostats or cotton forceps. If you are unable to retrieve them, fill out a NAVMED 6700/4 and have a DET remove them. Never turn the amalgamator upside down and attempt to shake them out. This could cause excess

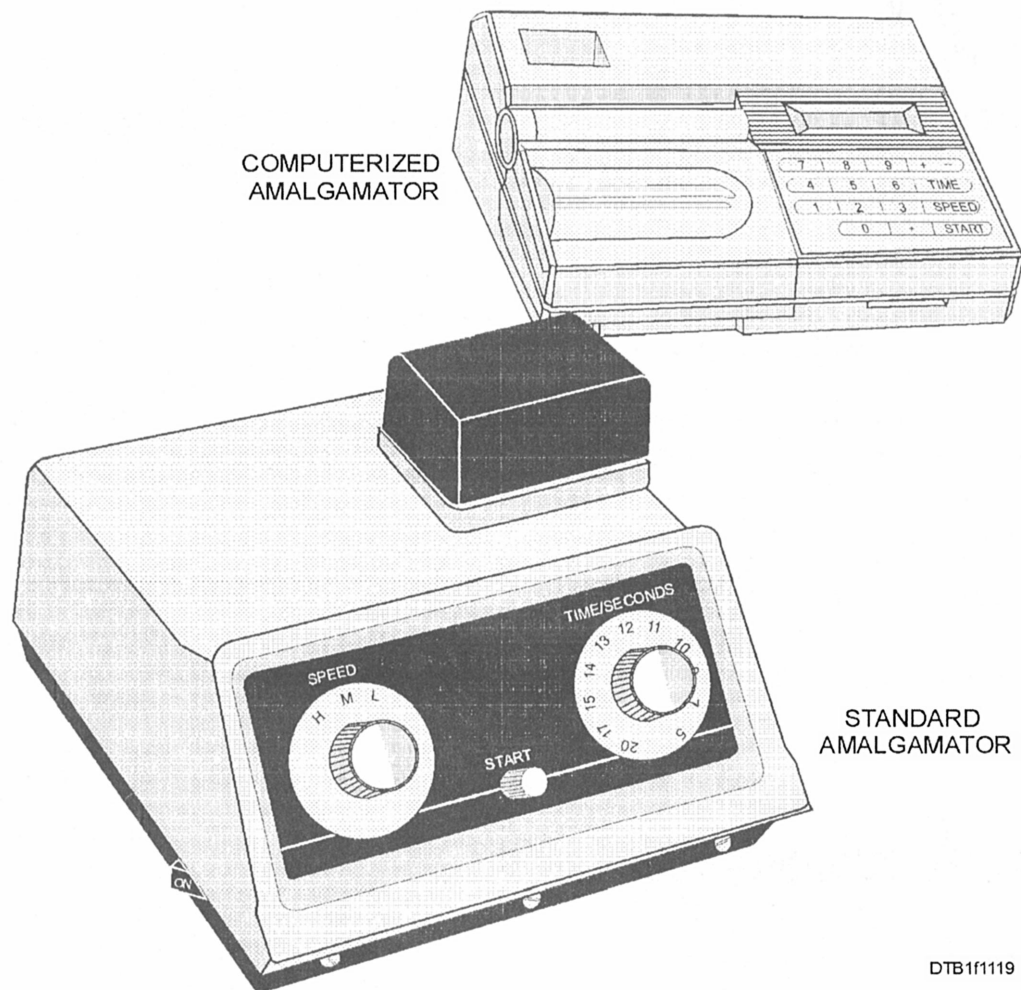


Figure 11-19.—Amalgamators.

mercury from broken capsules from being spilled. Refer to the manufacturer's instructions for operation and maintenance.

### VISIBLE LIGHT CURING UNIT

Many dental materials are now cured or set by a visible light in the high intensity (blue) range. The visible light curing (VLC) technique has varied applications in dental materials, including pit and fissure sealants, resins, impression materials, and surgical dressings, to name only a few. Most hand-held VLC units (fig. 11-20) contain a quartz halogen lamp that produces a high-intensity light to induce curing (hardening). This allows the provider an unlimited amount of working time with the material. Some models have light tips that rotate to permit easy positioning. The high intensity light radiation emitted from the unit is capable of retinal injury from chronic exposure. The light should never be directed toward the eyes. Staff and patients should use protective glasses that match the unit's radiation output.

These units require minimal maintenance and adjustments. Clean the unit after each patient treatment following infection control guidelines. Read the manufacturer's instructions for specific requirements.

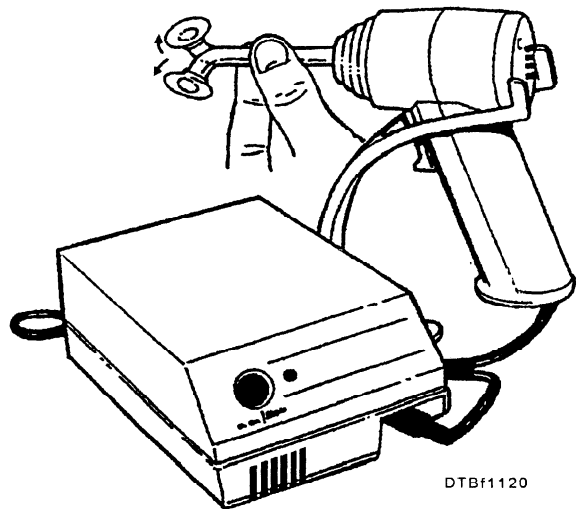


Figure 11-20.—Visible light curing unit.